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AUTHOR Michalowitz, Rina
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ABSTRACT

A study explored: (1) the possibility that imagination and imagery in young children can be developed by systematic practice; and (2) the extent to which the development of imagination and imagery affects other cognitive abilities, such as classification, seriation, and conservation. Concepts of imagery and operation schemes were derived from cognitive approaches oriented toward information processing and from Piagetian developmental theory. Participants were 133 children of 5 to 6 years of age, half of whom were disadvantaged. Children were divided into four treatment groups: two experimental and two control. Experimental groups received training in the use of operational schemes or imagery and imagination. Control groups received irrelevant training or no training. Training occurred in 50 sessions during a 3-4 month period. Results showed significant improvement due to training, and thus indicated a clear positive relation between the cognitive abilities studied. Disadvantaged children who before training were below advantaged children in the ability to use operation schemes and control imagination, reduced and sometimes even eliminated the gap after training. It is concluded that since training was more beneficial to the disadvantaged, there may be limits to the contribution experience can make to the development of the cognitive abilities tested. (RH)

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Summary

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THE DEVELOPMENT AND CULTIVATION OF IMAGINATION AND LOGICAL
OPERATIONS IN YOUNG CHILDREN

Rina Michalowitz, Ministry of Education, Israel

This study explored the connection between the capacity for imagery, imagination and the ability to use operational schemes, as well as the effects of the development of these abilities on each other. In order to explore the role played by maturation and experience, an attempt was made to expand each of the abilities through training.

133 children aged 5-6 years, half of them disadvantaged, formed four treatment groups: two experimental (training in the use of operational schemes, or in the capacity for imagery and imagination) and two control (irrelevant training or no training). Training lasted for 3-4 month (50 sessions).

Results show significant improvement due to training, both on the trained capacity as well as on the other; thus it is clear that positive relation exists between these abilities. Another significant finding is that disadvantaged children who, prior to training, were below advantaged in the ability to use operation schemes and in controllability of imagination (but not in vividness), reduced and sometimes even eliminated this gap after training. As training is more beneficial to the disadvantaged, it may be that there are limits to the possible contribution of experience to the development of the abilities tested.

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In the past decade, psychology has once more become interested in imagination and imagery as part of human cognitive function. Investigators have pointed out the importance of imagination in effective adaptation in many areas. HUTTENLOCHER for example (1968) showed the importance of visual imagination in problem solving. KAPLAN (1972) saw the possibility of imagining alternatives, and hence of predicting and conceptualizing the future, as functional in human adaptation. He stressed the importance of this ability now, in modern times. REESE (1970), ROWHER (1970) and PAIVIO (1970) saw imagination as a means of improving memory. LEVIN (1979) thought of imagination as a component in learning strategies. Developing imagination and imagery might therefore be useful. Hence the purpose of the present work: to examine the possibilities of developing imagination and imagery in young children by systematic practice, and to find out to what extent, if any, improving these abilities affects other cognitive faculties such as classification, seriation and conservation. These according to many, notably Piaget, are the basis of logical thinking.

The purpose of this study, then, was to explore the connection between cognitive abilities the capacity for imagery and imagination, and the

use of operation schemes - as well as the effects of the development of one ability on another. An additional purpose was to study the role of maturation and experience in the development of these abilities. The concepts of imagery and operation schemes were derived from cognitive approaches oriented toward information processing and from Piagetian development theory:

To test the effects of the development of one ability on the other, an attempt was made to expand each of the abilities through training. Based on the developmental theories of Bruner and Piaget and on the findings of cross-cultural research concerning these cognitive abilities, it was assumed that experience has a crucial effect on development. An additional assumption was that the effects of experience would be especially evident in a culturally and socially disadvantaged environment. Accordingly, five central hypotheses were proposed:

1. Training in the use of operation. Schemes will expand the capacity for imagery and/or imagination.
2. Training in imagery and imagination will improve the use of operation schemes.
3. Disadvantaged children prior to training will rate below advantaged children in their ability to use operation, schemes,

and they will also differ from them in their capacity for imagery and imagination.

4. In the use of operation schemes, the extent of the improvement resulting from training will differ in each population; the disadvantaged children will obtain the greater benefits.
5. In the capacity for imagery and imagination, the two populations will also benefit differently from the training: vividness of imagery and imagination will increase among the advantaged and controlability among the disadvantaged.

The sample consisted of 133 children aged 5-6 years, divided about evenly between disadvantaged and average backgrounds. Four treatment groups were formed, two experimental and two control. (insert Table 1) In one experimental group the children were given training in the use of operation schemes, and in the second they were trained in the capacity for imagery and imagination. In one control group the children were given training in motor coordination that was irrelevant to the cognitive abilities being studied, and in the second control group no training at all was given. Each child completed an individual pre-test and post-test. This test was comprised of a test on the use of operation schemes (categorization, classification, conservation, ordering, analogical thinking and generalization); a test specially designed for the present study on the capacity for imagery

and imagination, and a vocabulary test as a means of controlling for intelligence. (Insert Table 2).

Following the pre-test, the children participated in fifty group meetings of twenty minutes duration each, five days a week. Each group consisted of six children and belonged to one of the four treatment groups described above. For each group, fifty instructional units were developed for use by a specially trained instructor. Following the completion of all fifty units, the children were given the post-test.

Let me elaborate a little on the test to evaluate imagery and imagination.

The ideas for these tests were taken from central theories present in the last decade, such as those of RICHARDSON (1969) and others. Related to various characteristics of imagination, among them vividness and controllability. Vividness means the ability to see and object or event alive and in detail in the mind's eye. In our test, vividness was measured by the wealth of detail in the story told by the testee after a picture was shown to him or her. The more detail was given, the more mention was made of things beyond those in the actual picture, the higher the score was. Controllability as regards imagination is the ability to follow instructions directing it from one subject to another, and to activate it within a given framework.

This is measured by the testee's ability to go from one subject to another, and to relate relevantly to a new picture by connecting imaginatively between situations portraged in several pictures, or even by finding interconnections in the contents of several pictures that do not appear to be related to one another.

Following Piaget, we sought to examin static imagination, which relates to a situation and tranforming imagination relating to a process, reproductive imagination and anticipatory imagination, which is the child's ability to relate to situaitons never experienced. (See Appendix).

C content analysis was made of the children's stories. Points were given for mention of time or place in relation to a story, to the characters involved and the things they said, etc. In the second part of the test, there were several tasks related to sheppard (1969, 1978) and other who have related to the ability to manipulate imagery, to rotate or superimpose images in the imagination. The tasks were carried out by means of transparencies, mirrors, and flags.

We analysed our findings using a series of statistical tools, the first of which was multidimensional scaling, and this is what we found:

1. A multidimensional scaling analysis on the principal test measures demonstrated the existence of a three-dimensional configuration of cognitive abilities, as follows:
 - a. A dimension we called operation: transformation of information (logical operation) versus association (imaginative operation).
 - b. A dimension we called representation: verbal conceptual representation versus representation by imagery.
 - c. A dimension we called structure or quantity: sequential ordering of information or attention to individual stimuli, versus simultaneous structuring of a steadily increasing number of stimuli. (Insert Tables 3-4 here).
2. The configuration yielded by the analysis distinguished between tasks requiring imagination, like story-telling, and those requiring the manipulation of an image, as in mental rotation. No relation was found between these tasks, but one was found between the use of images and performance on the operation schemes test.
3. A factor analysis and further multidimensional scaling analyses yielded the two main dimensions of imagination-vividness and controlability. By these means we also found two dimensions of

logical operations: operations that depend on verbal conceptualization and those performed by anticipatory imagery.

4. The results showed that the children in the experimental groups demonstrated significant improvement in the ability for which they were trained, while the control groups showed no such improvement. Thus positive confirmation was obtained of the contribution of experience both to the development of the ability to use operation schemes and to the capacity to use the imagination. As previously stated, however, we did not find a relation between imagination and imagery. It cannot be claimed that training contributed to the development of the capacity for imagery, as this capacity improved in both the experimental and control groups.
5. Following training in one of the abilities - imagination or the use of operation schemes - improvement also occurred in the other ability. Thus it was made clear that a positive relation exists between the development of one ability and concurrent improvement in the other.
6. Prior to training, language performance was not found to be related to the use of imagination, but it was related to logical operations. This relation diminished after completion of the training.

7. Disadvantaged children who, prior to training, were below the advantaged in the ability to use operation schemes and in controllability of imagination, though not in vividness, eliminated this gap in several tests. Moreover, they reduced it significantly in other tests after the training. In vividness of the imagination, the disadvantaged children obtained even higher results than the advantaged children, following training.

These next two transparencies show our findings, but only schematically, because there are too many details that we cannot go into in the present framework.

On the basis of the empirical findings, the following conclusions were drawn:

- 1 The configuration of cognitive abilities revealed by the present study supported Piagetian ideas on two aspects of the thinking process, as well as the views of information processing theorists on the dual coding approach. The third dimension of cognitive ability - that of information structuring, may confirm recent theories about cognitive development, theories that relate to quantitative aspects of the thought process such as the M Factor (mental power that the individual can activate simultaneously. Several such descriptive thought processes were developed by Pasqual Leone and Ruby Cass. In fact, our research offers a

three-dimensional model of cognitive separations, which may be shown like this (Table 4):

2. A mutual relationship exists with regard to the development of the abilities tested in the present study. The development of the capacity for imagination has a bearing on the improvement of the ability to use operation schemes, and vice versa.
3. Experience has a positive effect on the application of these abilities. What is more, they can be improved through specific training. And, what is most important, the disadvantaged can benefit from training like that used in the present study.
4. The fact that advantaged children benefited less from the training than did disadvantaged children, suggests that there are limits to the possible contribution of experience to the development of the abilities tested.
5. One must related cautiously to the findings related to attempts to increase the capacity for imagery. Lack of success in improving the capacity for imagery through training may be attributed to various factors, such as the possibility that the children encountered difficulty in structuring the information simultaneously with the demands of too many individual stimuli given at once.

Based on these conclusions, further theoretical, and practical recommendations were made.

A systematic investigation of the dimension of the organization of information simultaneous organization of many stimuli as against serial organization of occasional stimuli.

There is a need to investigate the relation of this dimension to other dimensions of cognitive ability, to verbal and visual representation, and to logical and imaginative processes.

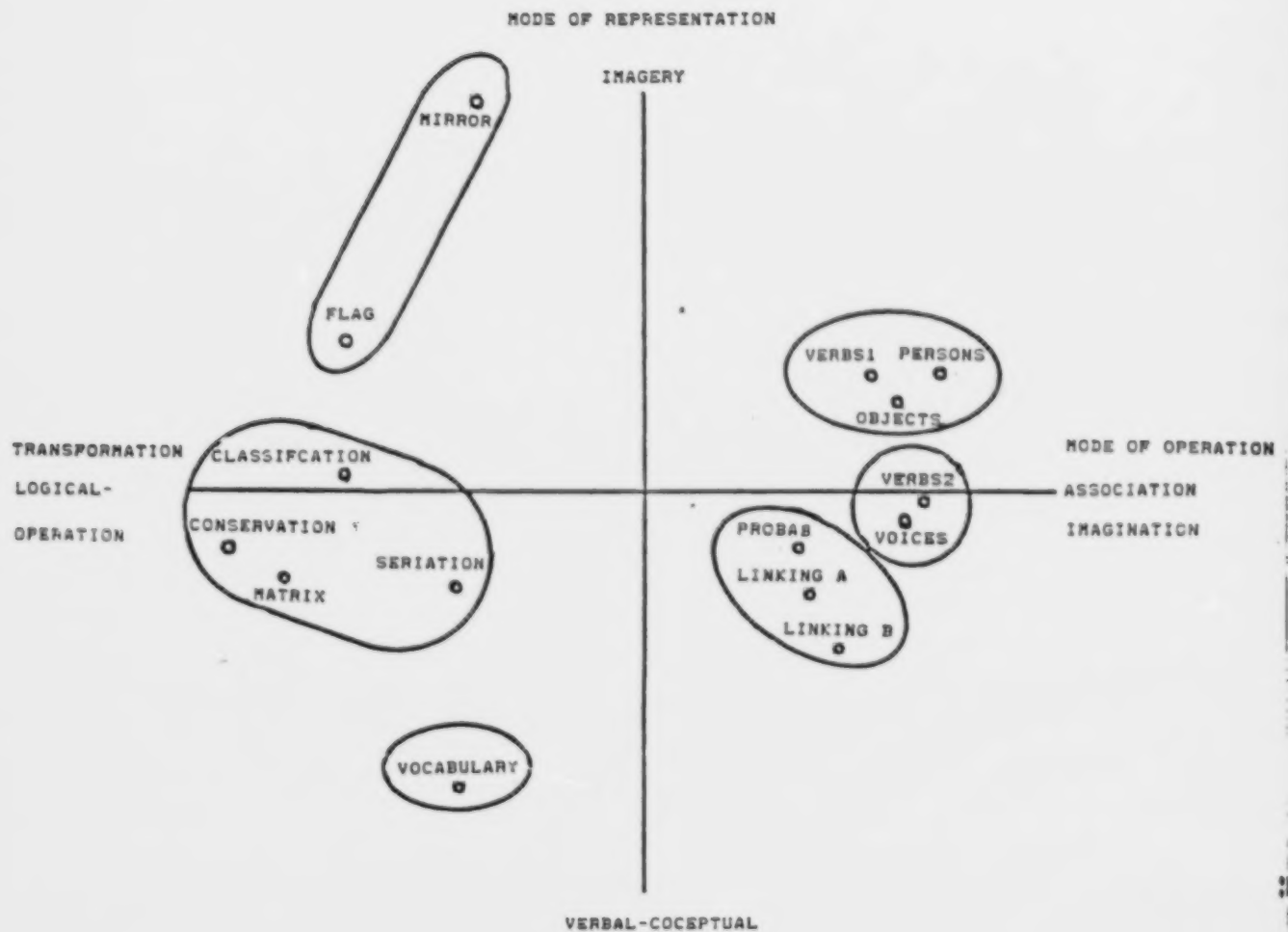
It would be desirable to investigate the role of maturation and learning in the development of ways that information is organized, and in the increasing ability to deal with greater amounts of stimuli.

As educators, it is important for us to know just what we can do for young children in this area. From our research, we have learned that practice both in the use of the imagination and in logical transformations has indeed helped disadvantaged children aged 5-6. Hence it seems to be a worthy investment of educational effort. It would also appear worthwhile to see what can be done for younger children for the 3-4 year old group. Who knows? Maybe in this way we can in some significant measure prevent the gaps in cognitive abilities that we find later on in their education among disadvantaged children.

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A TENTATIVE THREE DIMENSIONAL MODEL OF COGNITIVE ABILITIES

